

**RESPONSE UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 1792**

Attorney Docket No. 5576-177

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Takahashi et al.
Application Serial No.: 10/525,443
Filed: February 24, 2005
For: **METAL SULFIDE THIN FILM AND METHOD FOR PREPARING THEREOF**

Confirmation No: 3864
Group Art Unit: 1792
Examiner: Elizabeth A. Burkhart

Date: November 24, 2009

MAIL STOP AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REMARKS IN SUPPORT OF REQUEST FOR PRE-APPEAL BRIEF REVIEW

Sir:

This paper is submitted in support of the Pre-Appeal Brief Request for Review ("the Request") filed concurrently with a Notice of Appeal in compliance with 37 CFR § 41.31 and with the rules set out in the Official Gazette of July 12, 2005 for the claims finally rejected in the Final Office Action mailed August 24, 2009 ("the Final Action") and the Advisory Action mailed on October 30, 2009. No amendments are being filed with this Request.

Applicants present that the rejections are based on a clear error in understanding the applied reference and/or the lack of elements needed for a *prima facie* rejection of the pending claims. Claims 1, 8, 10, 11, 13 and 15 are pending in this application.

Grounds of Rejection

Claims 1, 8, 10, 11, 13 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Takahashi et al. (2000) *J. Mater. Sci.* **10**:2346–2348 ("Takahashi et al.") in view of Sasaki et al. (1999) *J. Mater. Sci. Lett.* **18**:1193–1195 ("Sasaki et al."). The Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the Fe/S flux ratio and temperature in a process for forming a pure pyrite film, as suggested by Sasaki et al., and using the suggested temperature range of Sasaki et al. in the process of Takahashi et al. to form a pure pyrite film at temperatures such as in the range of the method of the present invention.

Applicants respectfully disagree with the position taken by the Examiner. Applicants accordingly request review of the present application by an appeal conference prior to the filing of an appeal brief. In the interest of brevity and without waiving the right to argue additional grounds should this Petition be

denied, Applicants discuss hereinbelow particular errors made in the rejection of the claims. These errors of fact render the rejection improper under the patent laws.

Claims 1, 8, 10, 11, 13 and 15 are patentable over Takahashi et al. in view of Sasaki et al.

The Examiner sets forth in the Final Action and in the Advisory Action that, in view of the discussion by Sasaki et al., it would have been obvious to take and use the conditions of Sasaki et al. in the method of Takahashi et al. to prepare a pure pyrite film at lower temperatures than those as set forth by Takahashi et al.

Takahashi et al. discuss the preparation of a pure pyrite film by atmospheric pressure chemical vapor deposition (CVD) using ferric chloride (FeCl_3) and thioacetamide (CH_3CSNH_2) at temperatures of 723–773°K (450–500°C). By the admission of the Examiner, Takahashi et al. do disclose or suggest a growth temperature for the preparation of a pure pyrite film of 375–425°C (648–698°K) (*see* page 3 of the Office Action mailed March 6, 2009). As such, the disclosures of Takahashi et al. alone do not teach all elements of the instantly claimed method.

Sasaki et al. discuss the preparation of a pure pyrite film by double source vacuum vapor deposition using iron and sulfur powder. Sasaki et al. note that marcasite and pyrrhotite free pyrite films have been prepared by low pressure metalorganic chemical vapor deposition (MOCVD) using $\text{Fe}(\text{CO}_5)$ and di-tert-butyl disulfide (TBDS). The Examiner alleges that it would have been obvious to one of ordinary skill in the art at the time of the invention to use the temperatures suggested by Sasaki et al. (greater than 573°K) to prepare a pure pyrite film according to the method of Takahashi et al. in view of the reading of the comments by Sasaki et al. that at sufficiently high partial pressure of sulfur and temperature, a “pure pyrite [film] may be prepared by other methods.” (*see* p. 1193, last paragraph of col. 1 in Sasaki et al.). The “other” methods referred to are methods other than low pressure MOCVD using $\text{Fe}(\text{CO}_5)$ and di-tert-butyl disulfide (TBDS).

Sasaki et al. demonstrate that a pure pyrite film can be prepared by double source vacuum vapor deposition using iron and sulfur powder at temperatures greater than 523°K with an Fe/S flux ratio of greater than 6.8, and in so doing, show that a method other than low pressure MOCVD using $\text{Fe}(\text{CO}_5)$ and di-tert-butyl disulfide (TBDS), such as has been discussed by Schleich and Chang (1991) *J. Cryst. Growth* **112**:737–744 (“Schleich and Chang”), may be used to prepare a pure pyrite film.

The requirements for the establishment of a *prima facie* case for obviousness have been set forth in a previously filed paper. The disclosures of Takahashi et al. are related to atmospheric pressure CVD for preparing a pure pyrite film; the disclosures of Sasaki et al. are related to double source vacuum vapor

deposition for preparing a pure pyrite film; and, the disclosures of Schleich and Chang are related to low pressure MOCVD for preparing a pure pyrite film. The Examiner alleges that the disclosures of Sasaki et al. provide the teaching, suggestion and motivation to enable one of ordinary skill in the art to come to the conclusion that it would have been obvious to prepare a pure pyrite film by atmospheric pressure CVD using ferric chloride and thioacetamide at a temperature in the range of 375–425°C (648–698°K). While Sasaki et al. may demonstrate a method for preparing pure pyrite film using double source vacuum vapor deposition of iron and sulfur powder, so long as the Fe/S flux ratio is greater than 6.8 and the temperature is greater than 300°C (573°K), Sasaki et al. also admit, as noted above, that there are problems with the formation of marcasite when preparing pyrite films by low pressure MOCVD at temperatures below 723°K (*see* p. 1193, second to last paragraph of Sasaki et al.). Thus, while Sasaki et al. may describe a method for preparing a pure pyrite film by double source vacuum deposition at temperatures above 573°K, Sasaki et al. clearly do not suggest that such conditions, that are suitable for double source vacuum vapor deposition, are necessarily suitable for preparing a pure pyrite film by other methods.

The Examiner has previously set forth a rejection of claims 1, 9 and 13 under 35 U.S.C. § 103(a) as being unpatentable over Takahashi et al. in view of Schleich and Chang (*see* Office Action mailed August 27, 2008). This rejection was withdrawn by the Examiner in view of Applicants' persuasive arguments set forth in the amendment of December 2, 2008. By the admission of the Examiner, "[t]here would have been no motivation to combine the temperature ranges of Schleich and Chang with the disclosure of Takahashi et al. since Schleich and Chang teach a low pressure CVD method utilizing different reactants than the atmospheric pressure CVD method of Takahashi et al. and provides no suggestion that the temperature ranges utilized in their low pressure process would be suitable for any other deposition process, such as atmospheric pressure CVD." (*see* page 2, Office Action mailed March 6, 2009).

The disclosures of Sasaki et al. and Schleich and Chang are both related to vapor deposition performed at low pressure. At best, the disclosures of Sasaki et al. may suggest that sufficiently high partial pressure of sulfur and sufficiently high temperatures are critical in a method for preparing a pure pyrite film. However, when taken *as a whole*, the disclosures of Sasaki et al. do not suggest that the temperature range (greater than 573°K) that is suitable for forming a pure pyrite film by double source vacuum vapor deposition would be suitable for any other deposition process, such as a low pressure MOCVD method, such as set forth by Schleich and Chang, or the atmospheric pressure CVD method of the present invention. Furthermore, the reactants of Sasaki et al. and Schleich and Chang differ significantly from each other and from those of the present invention.

As set forth previously, Sasaki et al. do not disclose a method for forming a pyrite film using atmospheric pressure CVD. The prior art teachings indicate that at lower temperatures, marcasite formation is an issue in preparing pyrite films. There is no teaching in Takahashi et al. that temperatures lower than 723°K are suitable for preparing pure pyrite films by atmospheric pressure CVD. Other than indicating that high temperatures and high partial pressure of sulfur are factors for a method involved in preparing a pure pyrite film, Applicants assert, as one of skill in the art will appreciate, that there is no indication in the prior art that the temperatures and conditions used in the method as set forth by Sasaki et al. are generally applicable for any other methods and reactants as concluded by the Examiner. Furthermore there is no suggestion or motivation in the teachings of Sasaki et al., which submit that high temperatures are required to form a pure pyrite film, to drop the temperatures in a method for preparing a pure pyrite film, as discussed by Takahashi et al., to the range as instantly claimed. This is supported by comments by Sasaki et al., discussed above, that at lower temperatures, the formation of marcasite is an issue for any method for preparing pure pyrite films.

In view of the foregoing, Applicants submit that the instant claims are patentable over Takahashi et al. in view of Sasaki et al. for the same reasons that the Examiner has admitted that the instant claims are patentable over Takahashi et al. in view of Schleich and Chang and request that the outstanding rejection of the instant claims be reversed by the appeal conference prior to the filing of an appeal brief.

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CONCLUSION

Applicant submits that the present application is not in condition for appeal because of a clear error in facts and/or lack of elements needed for the *prima facie* rejection as noted above, and thus respectfully request that the application be passed to issuance.

No fee is believed due with the filing of this paper. This amount is believed to be correct. However, the Commissioner is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-0220.

Respectfully submitted,



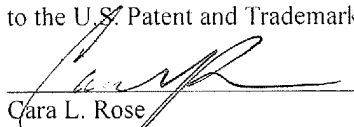
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CERTIFICATION OF ELECTRONIC TRANSMISSION

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Cara L. Rose